MEMO

From: F. Baneyx
Subject: Transport Coefficients

It is occasionally necessary for us to obtain values for transport properties of materials with which we work in the laboratory. This information is not always available in the literature, and we must sometimes make the measurements ourselves. Our laboratory, however, has not yet established standard procedures for the determination of the thermal conductivity and thermal diffusivity of solids, the heat transfer coefficients for solid/fluid interfaces, and the viscosity of fluids.

We would like you to develop and test simple methods for measuring these transport coefficients. Specifically, we are asking that you:

(1) Develop procedures for determining the thermal conductivity and thermal diffusivity of a brass rod of a standard alloy of unknown composition using both steady state and transient approaches.

(2) Develop a simple experimental design to measure the viscosity of water and at least two other liquids. For these measurements, avoid elaborate equipment and complicated procedures. You can use a falling sphere method for more viscous fluids or tank drainage or funnel drainage experiments for water. We are particularly interested in how various pipes affect the determination of water viscosity in tank drainage experiments.

(3) Discuss what other means of measurements you would use to measure the viscosity of a fluid. Focus on how would you measure viscosity accurately and what equipment or tools you would need? Also, discuss other experimental techniques to measure thermal conductivity and thermal diffusivity.

In your report, include an error analysis and a discussion of the sources of error in the measurements and design. Compare you results with literature values whenever possible.